

fact seems to be that up to a certain point the story of the Great Auk can be worked up and told by any one willing to labour at it. Beyond that point the difficulties begin. Mr. Grieve appears to be hardly aware of the existence of these difficulties, though some of them have been hinted at, if not pointed out, by his predecessors. The most serious charge that can be brought against him is that he has needlessly raised fresh difficulties for future investigators. Mistakes that have taken years of labour to correct, and the correction of which has been published, are again set agoing, just as if no progress in that direction had been made; and, even worse than this, some new assertions, or at least suggestions, are hazarded that have, I am persuaded, no firm ground. No doubt on some of these points I may be prejudiced; but according to my knowledge I perceive that on too many questions Mr. Grieve has been unable to distinguish between good evidence and bad. However, there is in this book a distinct gain to all historians of the Garefowl, and that is the information here first placed on record by Mr. Champley of Scarborough, who is known to have interested himself for many years in all that concerns this species.

I most sincerely wish that I could accord higher praise to this work than I have been able to do, for Mr. Grieve's enthusiasm in the cause deserves greater success. It is seldom that any one but a Fennimore Cooper or a Charles Kingsley feels the romance that clings around the history of an expiring race. Most men—men of science especially—nowadays believe in the survival of the fittest, and are content to let the dead bury their dead. The moral lesson I do not venture to draw, and in conclusion have only to ask pardon of the readers of NATURE for putting myself so forward in this article.

ALFRED NEWTON

"THE WAVE OF TRANSLATION"

The Wave of Translation in the Oceans of Water, Air, and Ether. By John Scott Russell, M.A., F.R.S. (London: Trübner and Co., 1885.)

THE late Mr. J. Scott Russell was one of the most prominent and gifted naval architects which this country possessed in the middle of the present century. His name will long be remembered as the builder of the *Great Eastern*, the early advocate of the longitudinal system of framing iron and steel ships: the ingenious and eloquent expounder of the "wave-line" principle of design; and for many improvements in the theory and practice of iron steamship construction. His personality was at once striking and attractive, and his abilities were of an original and versatile kind. He was the author of a massive work upon naval architecture; and of numerous papers read before various learned societies. No one exercised greater influence than Mr. Scott Russell in promoting the cause of scientific education in naval architecture, and in stimulating and helping students, by numerous speeches and writings, to acquire a general and clear knowledge of the laws upon which the qualities of ships depend.

Mr. Scott Russell's writings were always interesting. He possessed the rare faculty of making the driest and most complicated of subjects intelligible, and even

fascinating. Where he may not be correct in the hypotheses, or justified in the sweeping generalisations, he sometimes hastily put forward, he is usually suggestive, and provocative of thought upon the part of his readers. He was a vigorous and clear—though with a tendency to be a too rapid—thinker; and there are no writings upon naval architecture which have the power of fixing the attention and stimulating the intellect in a greater measure than those of Mr. Scott Russell.

We regret to say that the present work is not likely to add to the reputation of its author. It exhibits *les défauts de ses qualités* in their most pronounced form; and if we were asked for an example of Mr. Scott Russell at his very weakest and worst we could hardly do better than refer to that portion of this book which has not been before published. One-half of the volume is devoted to a reprint of the Report made by Mr. Scott Russell to the British Association in 1842-43, in which a description is given of the "solitary wave of translation," which he discovered for himself in 1834, and the properties of which he did much to investigate and make known. This Report is not only printed *in extenso*, but Part I. of the work consists exclusively of extracts from it. The same matter appears twice over—once as Part I. of the book, and once as portions of the British Association Report. The Report describes the knowledge possessed by Mr. Scott Russell in 1843 of "the varieties, phenomena, and laws of waves, and the conditions which affect their genesis and propagation." This may be interesting from a biographical point of view, but its present scientific value is not great. Many things have happened since the date of this Report, such as the theoretical investigations of Airy, Stokes, Rankine, Froude, eminent French mathematicians, and others; and numerous observations have been made of the forms and properties of waves by scientific officers of our own and foreign navies. These constitute a mass of information which the present work completely ignores.

One half of the book is taken up with the reprint of the British Association Report referred to, and with those extracts from it of which Part I. is made up. The remaining half contains the only new matter now published. This is divided into two sections, one being "on the analogy between the solitary wave in water and the sound wave in air," and the other "on the great ocean of ether and its relation to matter." The less said of these chapters the better. The following is an instance of how Mr. Scott Russell frames a theory or invents a hypothesis: "I am so impressed with the truth of this law, that the velocity of this solitary wave in any fluid is due to the depth of the fluid in which it moves, whether thick or rarefied, that I hazard the hypothesis, that in the unknown element which pervades the universe, and which, though unknown, is the cause and medium of the most familiar phenomena of everyday life, proceeding on the same basis of calculation as in the air and water occurs, we shall find that the ethereal ocean should be given a height of 5,000,000,000 miles, and that the corresponding velocity of the solitary wave through that ocean would be 1,000,000,000 feet per second."

An atomic theory is framed upon the following basis: "The law of attractive force in the atom, in conformity with the law of Newton, is according to the *square of the*

nearness, and I propose to take as the law of repulsive force, the *cube of the nearness*. I think I am justified in taking this as the true law of repulsion of atoms of matter, because I find from the researches of eminent chemists that all free gases do so expand as to double their bulk by an increase of the distance of the particles, in the ratio of the cube of their nearness, or as 111 cube to 367." Then the theory of heat that is put forward appears to be a kind of material theory: "We may therefore define heat as the *effort of ether to resist crowding*. . . . Ether existing all around us in a normal state, may be called *free ether*. Ether enclosed by force in limited space surrounded by material atoms is imprisoned or stored ether; its greater or less degree of crowding or storing means degrees of heat, and the quantity of crowding among the atoms indicates the specific heat of these atoms, and sometimes the specific heat of that kind of matter."

One more extract and we have done:—"Even Sir Isaac Newton's calculations of the speed of sound fell 100 feet short of the truth, and therefore corresponded to an error of a mile in the height of the atmosphere, and he could invent nothing better to account for the error than this sudden inflammation of the atmosphere. To this the reply is that the existence of the solitary wave of translation was not known to Newton, that the nature of its genesis and propagation could not therefore be calculated; but that present knowledge of the nature and laws of this wave completely explain and accurately measure its phenomena without the introduction of any hypothesis contradicted by fact."

We have said enough to show the character of this treatise, and we will conclude by repeating that we are sorry to see a posthumous work by so eminent a man as the late Mr. Scott Russell, containing nothing more to justify its publication than a reprint of his well-known, and imperfect, views in 1843, upon wave motion, and a fanciful interpretation of great physical laws. It is a pity that greater skill and discretion were not brought to bear upon the production of this volume.

OUR BOOK SHELF

Publication of the Norwegian Commission of the Measurement of Degrees in Europe. (1) Geodetical Operations, Part IV. (2) Tidal Observations, Part III.

THE first of these publications contains an account of the northern portion of the trigonometrical work undertaken to connect the side Stokvola-Haarskallen with the side Spaatind-Næverfeld. The former side is directly connected to the base measured in 1864 near Levanger, as described in Parts I. and III. of the "Geodetical Operations."

A trigonometrical survey of this part of the country had already been made in 1835-6 by Gen. Broch, and it was at first hoped that this survey could be utilised, but on closer investigation it was found that the observations were not of sufficient precision to meet the requirements of the Commission for the Measurement of degrees in Europe, for which this work was to a great extent undertaken. The old stations were, however, utilised in the northern part of the triangulation; there the signals were well-built masonry cylinders. In the southern portion, however, the stations had in many cases entirely disappeared and had to be reconstructed. A careful description of each station is given, and in every case, with one or two exceptions, the signal could not be placed at the

centre of the station; the usual measurements for reduction were therefore made, and apparently with more than usual care. The observations were taken with a 10-inch universal instrument made by Olsen and with a 12-inch theodolite made by Reichenbach. It would appear that the graduation of these instruments is not of a very high order; at any rate, the differences in the readings are rather large, frequently exceeding 10": but in extenuation it must be said that the instruments were too small for the work and that the observations were made under considerable difficulties, owing to sea-fog and snow. There is nothing special to remark in the method adopted to adjust the observations, it being the usual method founded on the principle of least squares. It is shown that the mean error of the finally-adjusted angles is

$$0''.547 \pm 0''.029.$$

A diagram of the triangulation is given, from which it is seen that most of the triangles are well-conditioned; a few, however, are more elongated than they should be for good work, the triangle Munken, Stokvola, Haarskallen, especially so; for instance, the angle at Munken is $5^{\circ} 12' 57''.416$. It should also be observed that several of the stations are determined by only two intersections. The longest side measures about sixty miles.

The second publication is the third report of the Norwegian tidal observations, and contains the results of the work done at Oscarsborg in 1880-1 and at Stavanger, Bergen, Kabelvaag, and Vardø in 1883. This report is simply a continuation of Reports I. and II., already noticed in NATURE; it contains nothing but tables, and there is nothing in it that calls for special notice.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

On the Influence of Wave-Currents on the Fauna of Shallow Seas

FOR many years past I have endeavoured, without much success, to call attention to the widely-spread influence of waves on the bottoms of shallow seas. To the geologist this action signifies denudation, and accounts, among other things, for the wholesale destruction of marine fauna so often exemplified in the rocks. To the zoologist it signifies a factor in evolution of immeasurable magnitude.

On seeing the abstract of Prof. Moseley's lecture on the fauna of the sea-shore in NATURE, I troubled you with my letter of July 6; now that the full report has appeared, equally reticent as to the significance of wave-currents, I ask leave to add somewhat to my former letter.

The difficulty in arousing interest in this subject arises from the fact that, though the phenomena of wave-disturbance are well known to mathematicians, natural history text-books commonly agree in asserting either the non-existence, or unimportance, of such disturbance. Thus the question has remained unheeded.

My own experience in the matter is as follows:—Holding the orthodox view of the peaceful repose existing on the sea-bottom, I commenced cruising, some twenty years ago, on that excellent natural experimental tank, Torbay. I soon found, to my surprise, that the local fishermen and dredgers were as confident that the waves greatly disturbed the bottom as naturalists were of the reverse. Having kept my eyes open in this direction, I submitted a paper to the Devonshire Association in 1878, descriptive of the levelling action of the waves on the six-fathom area of Torbay (*Trans. Dev. Assoc.*, vol. x. p. 182).

With the kind assistance of Lord Rayleigh I was enabled to show that theory and observation were in complete accord a